RB1 gene

RB transcriptional corepressor 1

Normal Function

The *RB1* gene provides instructions for making a protein called pRB. This protein acts as a tumor suppressor, which means that it regulates cell growth and keeps cells from dividing too fast or in an uncontrolled way. Under certain conditions, pRB stops other proteins from triggering DNA replication, the process by which DNA makes a copy of itself. Because DNA replication must occur before a cell can divide, tight regulation of this process controls cell division and helps prevent the growth of tumors. Additionally, pRB interacts with other proteins to influence cell survival, the self-destruction of cells (apoptosis), and the process by which cells mature to carry out special functions (differentiation).

Health Conditions Related to Genetic Changes

bladder cancer

Some gene mutations are acquired during a person's lifetime and are present only in certain cells. These changes, which are called somatic mutations, are not inherited. Somatic mutations that turn off (inactivate) the *RB1* gene have been reported in some cases of bladder cancer. Mutations in *RB1* are thought to contribute to the development of bladder cancer, and these genetic changes may help predict whether tumors will grow rapidly and spread to other tissues.

retinoblastoma

Hundreds of mutations in the *RB1* gene have been identified in people with retinoblastoma, a rare type of eye cancer that typically affects young children. This cancer develops in the retina, which is the specialized light-sensitive tissue at the back of the eye that detects light and color. Researchers estimate that 40 percent of all retinoblastomas are germinal, which means that *RB1* mutations occur in all of the body's cells and can be passed to the next generation. The other 60 percent are non-germinal, which means that *RB1* mutations occur only in the eye and cannot be passed to the next generation.

In germinal retinoblastoma, an *RB1* mutation is present in all of the body's cells. For retinoblastoma to develop, the other copy of the *RB1* gene also must be mutated or lost. This second mutation typically occurs early in life in retinal cells. Cells with two altered copies of the *RB1* gene produce no functional pRB and are unable to regulate cell division effectively. As a result, retinal cells lacking functional pRB can

divide uncontrollably to form cancerous tumors. Some studies suggest that additional genetic changes can influence the development of retinoblastoma; these changes may help explain variations in the development and growth of tumors in different people.

In people with germinal retinoblastoma, *RB1* mutations increase the risk of several other cancers outside the eye. Specifically, these people are more likely to develop a cancer of the pineal gland in the brain (pinealoma), a type of bone cancer known as osteosarcoma, cancers of soft tissues such as muscle, and an aggressive form of skin cancer called melanoma.

Non-germinal retinoblastoma occurs in people with no history of the disorder in their family. Affected individuals are born with two normal copies of the *RB1* gene. Then, usually in early childhood, both copies of the gene in retinal cells acquire mutations or are lost. These genetic changes prevent the cells from producing any functional pRB. The loss of this protein allows retinal cells to grow and divide without control or order, leading to the development of a cancerous tumor.

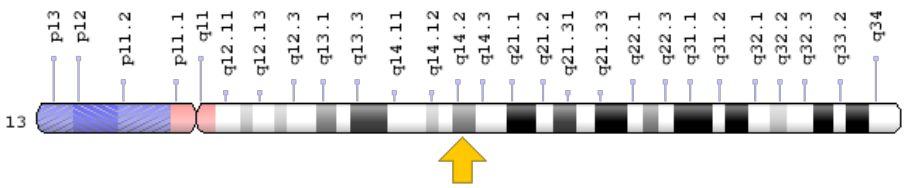
other cancers

In addition to bladder cancer, somatic mutations in the *RB1* gene are associated with many other types of cancer. For example, changes in the *RB1* gene have been reported in some cases of lung cancer, breast cancer, a bone cancer known as osteosarcoma, and an aggressive form of skin cancer called melanoma. Somatic *RB1* mutations have also been identified in some leukemias, which are cancers of blood-forming cells. Somatic *RB1* mutations in cancer cells inactivate pRB so it can no longer regulate cell division effectively.

Chromosomal Location

Cytogenetic Location: 13q14.2, which is the long (q) arm of chromosome 13 at position 14.2

Molecular Location: base pairs 48,303,747 to 48,481,890 on chromosome 13 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- p105-Rb
- PP110
- PPP1R130
- RB
- RB1 gene
- RB_HUMAN
- retinoblastoma 1
- Retinoblastoma-1
- Retinoblastoma 1 (including osteosarcoma)
- Retinoblastoma-associated protein

Additional Information & Resources

Educational Resources

- Cancer Medicine (sixth edition, 2003): Retinoblastoma—A Paradigm for Tumor-Suppressor Gene Function
  https://www.ncbi.nlm.nih.gov/books/NBK13944/
- Molecular Biology of the Cell (fourth edition, 2002): Tumor Suppressor Genes Can Sometimes Be Identified by Study of Rare Hereditary Cancer Syndromes
  https://www.ncbi.nlm.nih.gov/books/NBK26816/#A4314

GeneReviews

- Retinoblastoma
  https://www.ncbi.nlm.nih.gov/books/NBK1452

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28RB1%5BTIAB%5D%29+OR+%28Retinoblastoma+1%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+360+days%22%5Bdp%5D

OMIM

- RB1 GENE
  http://omim.org/entry/614041

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/RB1ID90.html
- Cancer Genetics Web
  http://www.cancerindex.org/geneweb/RB1.htm
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=RB1%5Bgene%5D
- HGNC Gene Family: Endogenous ligands
  http://www.genenames.org/cgi-bin/genefamilies/set/542
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=9884
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/5925
- UniProt
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